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(54) Method and apparatus for remotely altering programmable firmware stored in an interface board coupled to a network peripheral

Verfahren und Gerät zur Fernveränderung von, in einer an eine peripherale Netzeinrichtung gekoppelte Schnittstelle, gespeicherte Programme

Méthode et appareil pour modifier à distance des programmes logiciels mémorisés dans une carte interface couplée à un périphérique de réseau

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(56) References cited:
EP-A- 0 358 292
EP-A- 0 365 200
WO-A-89/05551
GB-A- 2 231 180

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extended status information about the printer will still be available if the CPCONSOL utility (discussed above) is executed in the network administrator's PC 14.

[0064] As mentioned above, the NEB 2 includes embedded software programs CPSERVER and CRPRINTER which enable the NEB to act with either PSERVER or RPRINTER functionality on the network. The customized NEB-embedded software which permits peripheral status and control information over the LAN is CPSOCKET (to be discussed in section 4j below). CPSOCKET runs on the NEB and monitors the LAN for communications addressed to both the NEB 2 and the attached printer 4. Further, CPSOCKET communicates with CPINIT and CPCONSOL when they are running. CPSOCKET will maintain a table of default settings for the device environment, download basic configuration information (fonts and emulations) at power-up, provide device information, statistics, and log information for CPCONSOL displays, and provide reset, reboot, and download capabilities. CPSOCKET will also be responsible for the configuration of the NEB 2. Further, CPSOCKET will configure and activate applications on the NEB at the request of CPINIT. CPSOCKET also insures that the correct protocol stacks are available for each configured application. CPSOCKET will handle the settings of the NEB 2 and the printer variables at the request of both CPINIT and CPCONSOL. Finally, the download facility (e.g. the network administrator's PC 14) will contact CPSOCKET to carry out any firmware downloading, such as flashing EPROM 222, that is required.

[0065] Upon initialization, programs such as CPINIT and CPCONSOL will issue a Service Advertising Protocol ("SAP") on the LAN looking for all network devices having the customized software of NEB 2. CPSOCKET will receive this broadcast signal and will respond. CPINIT or CPCONSOL then establishes a special connection with CPSOCKET using a customized client socket. CPSOCKET will then post multiple listens and will provide client service transactions such as NEB control, device information, basic configuration information, application information, statistics, and logging. For example, CPINIT can request that an application be configured, and CPCONSOL can request that an already-configured application be activated or deactivated. CPSOCKET will insure that the appropriate option (protocol stack) is available and configured for an application before allowing the application itself to be configured. Within the NEB, the CPSOCKET operational module is always activated.

[0066] Additional print service applications may be utilized after loading further application modules into the NEB, for example, UNIX print services and associated protocol implementation.

3d. PC-Resident Customized Software

[0067] To further enhance the functionality of the NEB 2, customized software is also provided to the network administrator's PC 14. For example, a Customized PCONSOLE ("CPCONSOL"; to be discussed in greater detail in section 4i below) utility provides extensions to Novell's PCONSOLE printer utility to enable access to the powerful control and monitoring features of the open-architecture printer 4. For example, the following are typical status control information available to the network from the printer through the use of CPCONSOL: (A) status and control information such as online/offline, no response, time/date/time zone, language, offsets, error skip settings, timer, buzzer enable, toner low, paper full, paper counter, count since last service, paper out, paper jam; (B) font information such as primary, secondary, graphic set, scaling, rotation, elite; (C) layout information such as page orientation, line pitch, character pitch; (D) quality and common environment information such as number of copies, overlay, job complete, command mode, default paper size, current paper size; and (E) configuration information such as interface, buffer size, feeder select, duplex print, page stack order, etc.

[0068] Furthermore, configuration data for the printer accessible to the network through the use of CPCONSOL includes: (A) network group information such as protocol type, the node name, the file server name, routing, POST error code, NEB firmware level, MAC address, server mode; and (B) printer group information such as safe (default) environment, font, disk present, disk size, initial environment, logging on/off, log file size, configured/nonconfigured, and net name. Additionally, logs can be kept of print job flow, print engine usage, and network behavior. Examples of such usage and statistical log entries include: (A) network group information such as receive statistics, transmit statistics, and non-media related information; (B) job entry information such as date/time/time zone, log-in (user's name), job name, pages, copy count, and print status; (C) initialization entry information; (D) error condition entry information; (E) clear log entry information; and (F) printer group information such as the number of jobs, pages/job, pages/minute, time/job, total pages/day, total jobs/day, number of days and total resets.

[0069] CPCONSOL is a menu-driven DOS executable program whose function is to provide extensions to the Novell PCONSOLE printer utility. The CPCONSOL extension enables access to the additional control and monitoring features of the open-architecture printer 4. These features will enhance print service management across the network by allowing the network administrator's PC 14 to control and maintain the printer from a remote location. In summary, CPCONSOL is the utility that exports printer control features to the network administrator, allows reconfiguration of the safe (default) environment, and allows the network administrator to view network and printer status, job statistics, and a log of the previously-processed jobs and error conditions. CPCONSOL gathers the requested information by communicating with the NEB-embedded software program module CPSOCKET.

of DRAM 220 (for example, through read/write cycles), operability of SCSI controller 224, data integrity of NVRAM 228, and operation of control register 230. POST may also include a comparison of the MAC address stored in PROM 232 with a MAC address downloaded into EPROM 222.

[0120] POST further includes operational checks of network-related hardware. More specifically, POST may include operability checks for SRAM 214 (for example, through read/write cycles), as well as a check of network activity to verify operation of network controller 206.

[0121] Operation of other hardware in NEB 2 may be determined directly through additional POST testing. In some cases, where it is not possible for microprocessor 216 to test operation of hardware directly, as in the case of connectors 202, 203 and 204, proper operation of that hardware may be implied through result codes received from direct testing.

[0122] Upon termination of POST, microprocessor 216 puts a checksum code onto serial port 218 and then enters a window of quiescent operation (for example, a one second window) during which microprocessor 216 can receive commands (e.g. for testing - see paragraph 5 below) via serial port 218. The POST checksum code may be obtained by a device coupled to serial port 218 to determine the outcome of POST. For example, a no error condition may be indicated by a POST checksum code of "0000h", while a POST checksum code indicating an error may be indicated by a non-zero hexadecimal value which indicates the area of failure. In the case of failure, microprocessor 216 may also illuminate LED 240 on NEB 2 to signal to a user that an error has been detected. Preferably, LED 240 is illuminated on power-up and is only turned off if POST is successful.

[0123] Following successful completion of POST and in the event that no commands are received via serial port 218 during the one second quiescent window of activity, microprocessor 216 begins to load software modules stored in EPROM 222 into DRAM 220. Microprocessor 216 does not execute those software modules directly from EPROM 222, but rather loads those modules into DRAM 220 for execution from DRAM 220. By virtue of this arrangement, it is possible to select the specific modules that are retrieved from EPROM 222 for execution out of DRAM 220 so as to permit flexible configuration of NEB 2 (see section 4d below). For example, in accordance with a configuration command stored in NVRAM 228, microprocessor 216 may retrieve selective modules from EPROM 222 for loading into DRAM 220 and for execution from the DRAM.

[0124] FIG. 6 shows the sequence by which different modules are retrieved from EPROM 222 and loaded into DRAM 220. In Step S6001, microprocessor 216 loads the SCSI driver from EPROM 222 into DRAM 220. The SCSI driver provides for operational sequence and control over SCSI controller 224 and permits interface with printer 4 so as to send printer 4 print data and so as to send and receive control information to and from printer 4.

[0125] In Step S6002, microprocessor 216 loads the link support layer, or "LSL", from EPROM 222 into DRAM 220, and in Step S6003 microprocessor 216 loads network driver software from EPROM 222 into DRAM 220, and thereupon microprocessor 216 begins to execute the link support layer and the network driver from DRAM 220. The link support layer and the network driver provide common access to LAN communications on LAN bus 6. More particularly, as shown in FIG. 7, all networked devices, including a device such as NEB 2, interface with LAN bus 6 via an electrical interface 301 such as the network controller 206 used on NEB 2. The electrical interface 301 is driven by network driver 302 which in turn receives LAN frame data from link support layer software 304. Both the link support layer 304 and the network driver 302 are common to different kinds of network software. For example, as further shown in FIG. 7, network application programs, such as those provided in NetWare® software by Novell (as illustrated at Arrow A) interface with the link support layer and the network driver via an internetwork packet exchange program, or "IPX", 305 and a sequenced packet exchange program, or "SPX", 306. On the other hand, network application programs from UNIX provided by AT&T (as illustrated at Arrow B) interface to the LSL through "IP" module 315 and "TCP" module 316.

[0126] In NEB 2, only one type of network application programs is normally executed at any one time (although multiprotocol operations are possible as discussed in section 4f below). Explanation here will be made for NetWare® network application programs although it is also possible for UNIX network application programs to be executed as well.

[0127] In Step S6004, microprocessor 216 loads a PRESCAN program from EPROM 222 and stores it into DRAM 220, and thereupon begins executing the PRESCAN program from DRAM 220. PRESCAN software interfaces with the link support layer to determine the frame packet type being transmitted on LAN bus 6. More particularly, as described above, there are four different possible frame packet types on an Ethernet-type network LAN bus: Ethernet 802.3, Ethernet II, Ethernet 802.2, and Ethernet SNAP. As described more fully below in section 4e, the PRESCAN software module monitors network communications on LAN bus 6 to determine the frame packet type. The frame packet type, once determined by PRESCAN, is stored in a predetermined common location in DRAM 220 for use by other network communication modules in the NEB. After determining the frame packet type, PRESCAN signals microprocessor 216 that its tasks are completed and allows microprocessor 216 to overwrite the memory occupied by the PRESCAN program with another program module.

[0128] In Step S6005 microprocessor 216 retrieves the IPX and SPX program modules from EPROM 222 and stores them in DRAM 220, and thereupon begins executing the IPX and SPX modules from DRAM 220. Both IPX and SPX use the frame packet type determined by the PRESCAN module.

[0129] In Step S6006 microprocessor 216 retrieves the CNETX program module from EPROM 222 and loads that

module into DRAM 220 and thereupon begins execution from DRAM 220. CNETX provides localized DOS-like functionality to the NEB.

[0130] In Step S6007, microprocessor 216 loads the SAPSERVER program module from EPROM 222 into DRAM 220 and begins executing the SAPSERVER module from DRAM 220. As described more fully below in section 4g, SAPSERVER is a program module which allows two network server entities, such as CPSOCKET and CPSERVER, to advertise simultaneously from the single network node assigned to the NEB board, even though conventional network application programs such as those provided by NetWare® only permit advertising of a single network server entity from each network node.

[0131] In Step S6008 microprocessor 216 retrieves the non-preemptive multi-tasking MONITOR (see section 4i below) from EPROM 222 and stores it into DRAM 220 and begins executing the multi-tasking monitor from DRAM 220.

[0132] In Step S6009 microprocessor 216 retrieves the CPSOCKET server software module from EPROM 222 and loads it into DRAM 220 and begins executing the CPSOCKET servor from DRAM 220. As will be described more fully below in section 4j, CPSOCKET initiates a request to SAPSERVER to advertise on behalf of CPSOCKET, and SAPSERVER begins making SAP advertisements on LAN bus 6.

[0133] In Step S6010 microprocessor 216 retrieves print application servers such as CPSERVER or CRPRINTER from EPROM 222 and loads the print application servers into DRAM 222. In the case of CPSERVER, microprocessor 216 begins executing the loaded print application servers from DRAM 220 which in turn requests SAPSERVER to make SAP advertisements on behalf of the print server. As described more fully below in section 4g, SAPSERVER interleaves advertisements for the CPSOCKET server and for the print server thereby acting as a surrogate SAP entity for both the CPSOCKET server and the print server.

4b. Interfacing A Peripheral With A Local Area Network

[0134] According to the broad aspects of the present invention, a peripheral such as a printer is coupled to a LAN using an interactive network board having software programs embedded therein. Preferably, the connection between the printer and the NEB is an SCSI interface so that large amounts of print data and status data are carried bi-directionally between the NEB and the printer. EPROM 222 stores a plurality of software modules for operationally configuring the NEB in the PSERVER or RPRINTER or LPR functional configurations. The EPROM 222 also stores a number of status control software modules for exporting status information from the printer over the LAN, and for importing control information from the LAN to the printer. The EPROM-resident firmware is downloaded to the DRAM 220 upon power-up (as discussed in section 4a above), whereby the MONITOR multi-tasking program executes soft-time tasks until run-time interrupts are received from either the LAN or SCSI interfaces.

[0135] NVRAM 228 stores a configuration word which specifies which modules stored in EPROM 222 should be downloaded into DRAM 220 in order to configure the NEB with either a PSERVER or RPRINTER functionality. The microprocessor 216 executes the programs from DRAM 220, allowing print jobs to be received from the LAN and sent to the printer for printing, and allowing printer status to be returned over the LAN in response to a status request.

[0136] The particular details of the structure and functions for interfacing the peripheral to the local area network are set forth above with reference to FIGS. 4, 5A, 5B and 5C, and in the following sections.

4c. The Bi-Directional Interface Between The Local Area Network And The Printer

[0137] The provision of a bi-directional SCSI interface between the NEB 2 and the printer permits a large amount of status information to be extracted from the printer, while still providing the print data to the printer. Further, by utilizing the bi-directional SCSI interface, the printer can respond to control commands issued from a remote location over the LAN. For example, the network administrator may issue a control command from his/her PC 14 that requests a particular print job be printed a plurality of times, with high image density, and then stapled. Such control commands are sent to the NEB 2 over the LAN 6, and the NEB 2 transmits these control commands to the printer through the SCSI bus 102. At the same time, the actual print data is transferred from file server 30 to the NEB 2, where the print data is packaged in blocks and transferred to the printer over the SCSI bus 102. Preferably, the NEB 2 indicates the "start of print job" by opening the XP data channel to the printer. Likewise, the NEB 2 indicates "end of print job" by closing the XP data channel to the printer. Therefore, the NEB 2 can provide such indications to the printer.

[0138] The use of the bi-directional SCSI interface on the NEB 2 also permits other types of peripherals to be coupled to the LAN. For example, since the SCSI interface is capable of transmitting large quantities of data to the LAN from the peripheral, it is possible to couple the NEB to an image data generating device such as a scanner (e.g., where printer 4 is an Optical Character Recognition ("OCR") device) or a facsimile machine. Thus, data produced by the image generating device may be transferred to the NEB over the SCSI interface, and then put on the LAN for storage or retrieval by any of the LAN entities. As with a printer, large quantities of detailed control/status information can also be provided to/from the image data generating device.

(218) auf der Karte (2) zum Bereitstellen einer Kommunikationsverbindung mit einer Teststation (300), und wobei der Ladeschritt den Ladeschritt der ROM-Firmwareabbildung, des bezeichneten Identifikators und einer Prüfsumme über die Testschnittstelle aus der Teststation (300) in das RAM (220) enthält.

12. Verfahren nach einem der vorstehenden Ansprüche, ferner mit dem Schritt der Anordnung eines abgesetzten LAN-Gerätes (14) zum Fernladen der ROM-Firmwareabbildung, des bezeichneten Identifikators und einer Prüfsumme über die Schnittstelle (101) des lokalen Netzes in das RAM (220).

13. Verfahren nach einem der vorstehenden Ansprüche, ferner mit dem Schritt der Anordnung einer SCSI-Schnittstelle (100) auf der Karte (2).

14. Verfahren nach Anspruch 1, ferner mit einem zusätzlichen Verifizierungsschritt, um vor dem Ladeschritt einen bezeichneten Identifikator in der ROM-Firmwareabbildung mit einem bezeichneten Identifikator, der in einem auf der bezeichneten interaktiven Netzkarte (2) angeordneten ROM gespeichert ist, zu verifizieren.

15. Vorrichtung zum Fernverändern einer ersten programmierbaren ROM-Firmwareabbildung, die in einem PROM (222) gespeichert ist, das auf einer bezeichneten interaktiven Netzwerkkarte (2) mit einer Schnittstelle (101) für ein lokales Netz angeordnet ist, mit:

einer Kommunikationseinrichtung (14) eines lokalen Netzes zum Aussenden einer Anfrage über ein lokales Netz (6) nach der bezeichneten interaktiven Netzwerkkarte (2), um eine Ortsinformation der bezeichneten interaktiven Netzwerkkarte (2) als Antwort auf die ausgesendete Anfrage zu empfangen, um eine Kommunikation mit der bezeichneten interaktiven Netzwerkkarte (2) aufzubauen und um an die bezeichnete Karte (2) eine neue ROM-Firmwareabbildung, einen bezeichneten Identifikatorcode, und ein Prüfsummenpaket zu senden;

einem auf der bezeichneten interaktiven Netzwerkkarte (2) befindlichen RAM (220) zum Speichern der geladenen neuen ROM-Firmwareabbildung, des bezeichneten Identifikatorcodes und des Prüfsummenpaketes;

einem auf der bezeichneten interaktiven Netzwerkkarte (2) befindlichen PROM (222) zum Speichern der ersten ROM-Firmwareabbildung und eines weiteren bezeichneten Identifikatorcodes;

einer auf der bezeichneten interaktiven Netzwerkkarte (2) befindlichen Vergleichseinrichtung (216) zum Ausführen einer Prüfsummenoperation an der in dem RAM (220) gespeicherten neuen ROM-Firmwareabbildung unter Verwendung des in dem RAM (220) gespeicherten Prüfsummenpaketes; und

einer Steuereinrichtung (216) zum Steuern des PROM's (222), um die vorbezeichneten ersten ROM-Firmwareabbildungsdaten zu bewahren, indem die ersten ROM-Firmwareabbildungsdaten in dem RAM (220) gespeichert werden, um vorbestimmte PROM-Speicherstellen zu löschen, und um die neue ROM-Firmwareabbildung aus dem RAM (220) in das PROM (222) zu laden.

16. Vorrichtung nach Anspruch 15, wobei die Vergleichseinrichtung (216) den in dem RAM (220) gespeicherten bezeichneten Identifikatorcode mit einem weiteren in dem ROM (222) gespeicherten Identifikatorcode vergleicht.

17. Vorrichtung nach Anspruch 15 oder 16, wobei die bezeichnete interaktive Netzwerkkarte (2) mit einem LAN-Drukker (4) verbunden ist.

18. Vorrichtung nach Anspruch 15, 16 oder 17,wobei das RAM (220) ein dynamisches RAM aufweist.

19. Vorrichtung nach einem der Ansprüche 15 bis 18, wobei das PROM (222) ein Flash-EPROM aufweist.

20. Vorrichtung nach einem der Ansprüche 15 bis 19, ferner mit einer auf der Karte (2) angeordneten Testschnittstelle zum Bereitstellen einer Kommunikationsverbindung mit einer Teststation (300), und wobei die neue ROM-Firmwareabbildung, der bezeichnete Identifikator und eine Prüfsumme über die Testschnittstelle (128) aus der Teststation (300) in das RAM (220) geladen werden.

21. Vorrichtung nach Anspruch 15, ferner mit einem abgesetzten LAN-Gerät (14) zum Fernladen der neuen ROM-Firmwareabbildung, des bezeichneten Identifikators und des Prüfsummenpaketes in das RAM (220).

22. Vorrichtung nach Anspruch 15, ferner mit einer SCSI-Schnittstelle (100).

23. Vorrichtung zum Femladen von ROM-Firmware in ein PROM (222), das auf einer mit einem LAN (6) verbundenen interaktiven Netzwerkkarte (2) angeordnet ist, mit:

einer auf der Karte (2) angeordneten LAN-Schnittstelle (101), um von einem abgesetzten LAN-Ort (14) die ROM-Firmware und ein Verifizierungssignal zu empfangen;

einem auf der Karte (2) angeordneten RAM (220), um die empfangene ROM-Firmware und das Verifizierungssignal zu speichern; und

einem auf der Karte (2) angeordneten Prozessor (216) um: (i) ein Speichern der empfangenen ROM-Firmware und des Verifizierungssignals in dem RAM (220) zu veranlassen; (ii) unter Verwendung des Verifizierungssignals zu verifizieren, daß die empfangene ROM-Firmware gültig ist, und (iii) die ROM-Firmware aus dem RAM (220) in das PROM (222) zu laden, wenn die ROM-Firmware gültig ist.

24. Interaktive Netzwerkkarte (2) für ein mittels eines abgesetzten LAN-Gerätes (14) programmierbares Peripheriegerät (4) zum Femladen neuer ROM-Firmware in ein auf der interaktiven Netzkarte (2) vorgesehenes PROM (222), mit

einer LAN-Schnittstelle (101), um von dem abgesetzten LAN-Gerät (14) die ROM-Firmware und ein Verifizierungssignal zu empfangen;

einem RAM (220), um die empfangene ROM-Firmware und das Verifizierungssignal zu speichern; und

einem Prozessor (216) um: (i) ein Speichern der empfangenen ROM-Firmware und des Verifizierungssignals in dem RAM (220) zu veranlassen; (ii) unter Verwendung des Verifizierungssignals zu Verifizieren, daß die empfangene ROM-Firmware gültig ist, und (iii) die ROM-Firmware aus dem RAM (220) in das PROM (222) zu laden, wenn die ROM-Firmware gültig ist.

25. Vorrichtung zum Femladen von ROM-Firmware in ein PROM (222), das auf einer mit einem LAN (6) verbundenen bezeichneten interaktiven Netzwerkkarte (2) angeordnet ist, wobei die Vorrichtung aufweist:

(i) eine Aussendeeinrichtung (14, EPFLASH), die so betreibbar ist, daß sie über das LAN (6) eine Anfrage nach der bezeichneten interaktiven Netzwerkkarte (2) aussendet;

(ii) eine Empfangseinrichtung (14, EPFLASH), die so betreibbar ist, daß sie die Ortsinformation der bezeichneten Karte (2) als Antwort aus die ausgesendete Anfrage empfängt;

(iii) eine Kommunikationseinrichtung (14), die so betreibbar ist, daß sie eine Kommunikation zu der bezeichneten interaktiven Netzwerkkarte (2) aufbaut;

(iv) eine Ladeeinrichtung (14), die so betreibbar ist, daß sie in die bezeichnete interaktive Netzwerkkarte (2) eine neue ROM-Firmwareabbildung, einen bezeichneten Identifikatorcode und ein Prüfsummenpaket lädt.

Revendications

1. Procédé pour écrire à distance un micrologiciel programmable, dans une PROM (mémoire morte programmable) (222) disposée sur une carte désignée (2) de réseau interactif comportant une interface (100) de réseau local, comprenant les étapes :

d'activation d'un programme de transmission de réseau local, ledit programme de transmission fonctionnant pour émettre (s2001) une demande par l'intermédiaire du réseau local (6) pour la carte désignée (2) de réseau interactif, pour recevoir (s2003) une information de localisation de la carte désignée (2) de réseau interactif en réponse à la demande émise, et pour établir une transmission (s2003) avec la carte désignée de réseau interactif ;
de téléchargement (s2004) d'une image de micrologiciel de ROM (mémoire morte) dans une RAM (mémoire

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